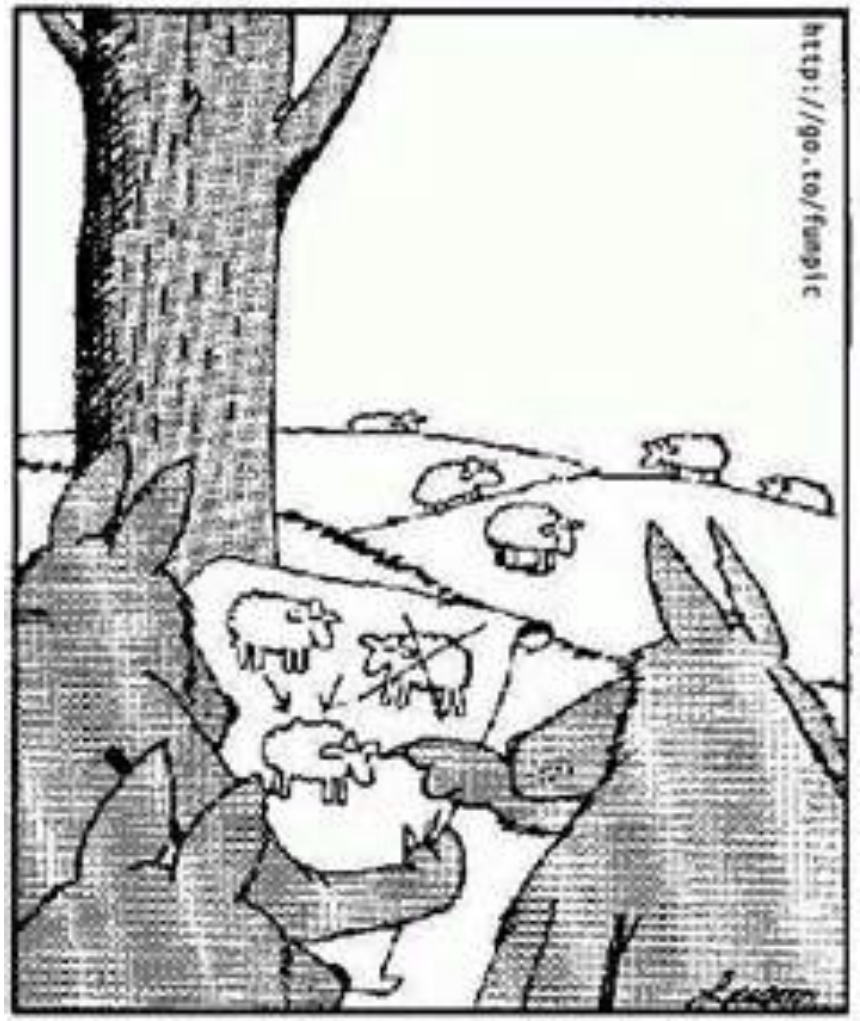
Is this cartoon funny? Why or why not?



Natural selection at work

Making Science Thinking Visible by Engaging Students in Speaking and Writing

Understanding and Using the Vision from the Framework for K-12 Science Education to Improve Science Teaching and Learning

Dec. 5, 2013

- Teachers who make use of well crafted writing tasks get students to reveal their thinking about science end up with students who write more, improve their writing and understand more science.

Partners

- Identify a partner.
- Decide who will be partner A and who will be partner B

Partners – One Minute Meeting

- ✓ Stand up
- ✓ Face your partner (partner A will be starting)
- ✓ You have 30 second to tell your partner about a writing task or technique you use with your students
- ✓ Switch roles, you have another 30 seconds
- ✓ Thank your partner
- ✓ Sit down

Our Journey Today

- **What** – Increase our capacity to support teachers in their transition to Common Core and Framework aligned instructional practices. Consider writing in science and methods to get more meaningful writing from students.
- **Why** – Common Core and Framework are here, we know much more about teaching and learning, and science education is undergoing change.
- **How** – By engaging in content with literacy embedded in it (using literacy to understand science) and reflecting on what Common Core and the Framework asks teachers of science to do.

Common Core and writing in Science

Types of writing called for in CC for Science

- Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
- Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately

Characteristics of student writing

- Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Draw evidence from literary or informational texts to support analysis, reflection, and research.

Typical Writing Tasks

- What does student writing look like in your classroom now?

Typical Writing Responses

Might they look something like this?

1. Acceleration
2. Force
3. Centimeters per second

Or like this?

1. The three major types of plate boundaries are convergent, divergent and transform
2. Meiosis is a process of cell division in which the number of chromosomes is cut in half.

Or like this?

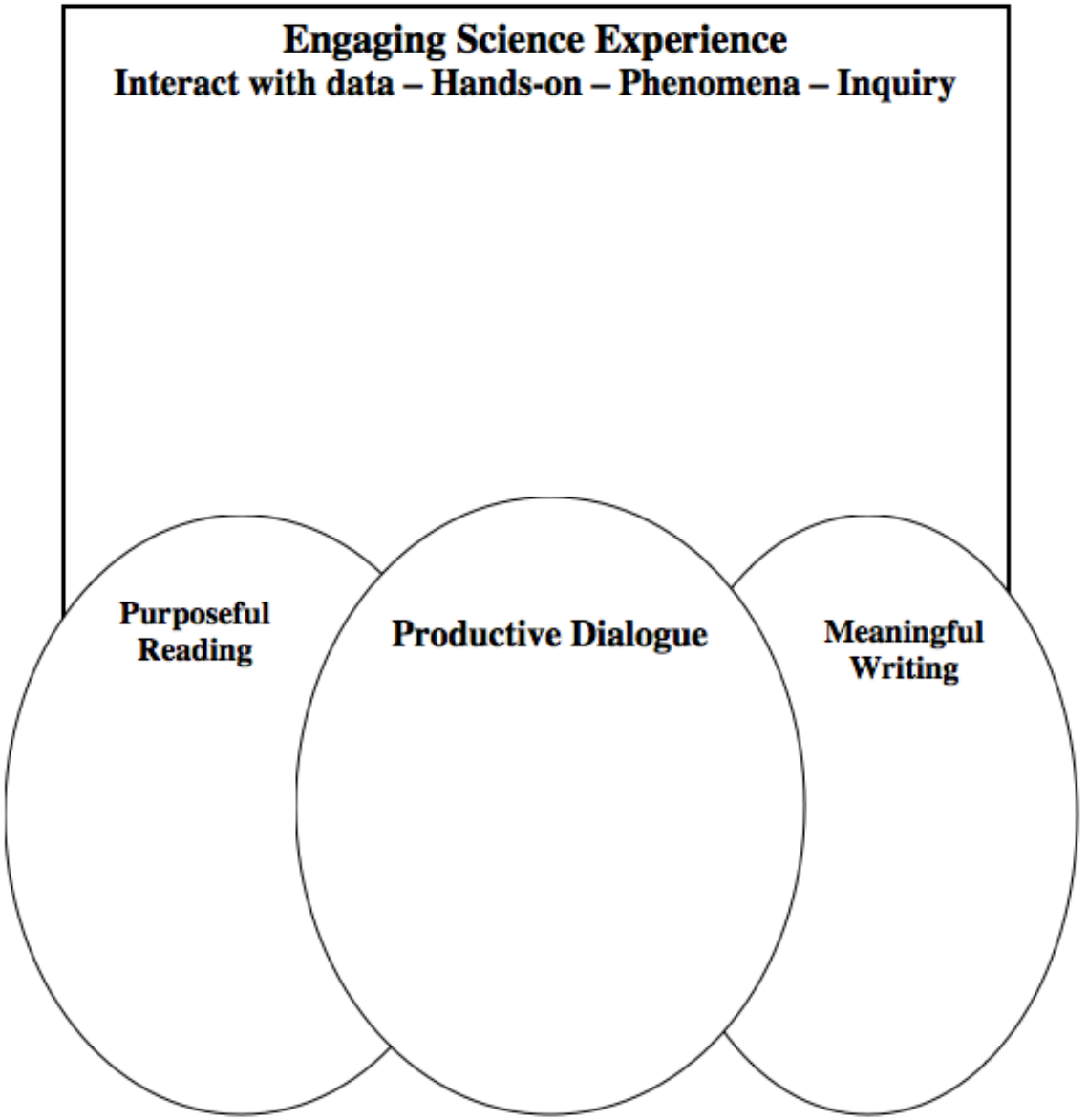
Our hypothesis was wrong. The experiment showed that ice floats higher in salt water.

In our lab the ball rolled up then down. The forces made it do this.

Typical Writing Tasks

- Do more complex organisms always have more chromosomes than simpler organisms?
- Why must chromosomes be copied before cells divide?
- How is ATP involved in cellular respiration?
- Explain why action and reaction forces do not cancel out, even though they have equal magnitudes and act in opposite directions.
- Why would you not be able to make jewelry out of sodium?
- What four factors affect how much damage is caused by an earthquake?
- Why is soil important?

Science Literacy Framework



Example Lesson - Biology

The Concept of Fitness

The following lesson was developed using the Science Literacy Framework©. The lesson is intended for teacher learning purposes and while possible for use in the classroom might require modifications based on teachers' instructional objectives and the level of students being served.

HANDOUT 1

Understanding Natural Selection:

The concept of Fitness

Step #1: Problematizing Fitness

Adapted from Evolution by Natural Selection
http://serendip.brynmawr.edu/sci_edu/waldron/pdf/NaturalSelectionProtocol.pdf.

Below are descriptions of four male lions. Which lion would biologists consider the "fittest"? Have a dialogue about this problem in your group. Use "Talking Sticks" to structure your conversation. Be prepared to explain your thinking about which is the "fittest" lion.

Name	George	Dwayne	Spot	Tyrone
Age at death	13 years	16 years	12 years	10 years
# of cubs fathered	19	25	20	20
# of cubs surviving to adulthood	15	14	14	19
Size (length)	10 feet	8.5 feet	9 feet	9 feet
Other information	George drove away more male lions trying to take over his family group than the other males did.	Dwayne had the most lionesses in his family group.	A fire burned Spot's home territory, and he moved his family group to a new area.	Tyrone's family group included four lionesses.

Talking Sticks

1. Each person places their pencil/pen (Talking Stick) in the center of the table.
2. To make a comment you must pick up your "Talking Stick" - then you speak and hold onto your "Talking Stick".
3. Once you are finished with your comment, set your "Talking Stick" in front of you and you are not allowed to comment again until all the other group members have had a turn (group members may pass their turn with the "Talking Stick").
4. After everyone in the group has had a chance to comment, repeat the process until time is up.

Summary Protocol

Evolution by Natural Selection

1. In small groups, one person keeps the group on-task.
2. Read one paragraph silently (leader makes sure all group members know where paragraph starts and ends).
3. After everyone in the group has finished reading the paragraph, the group discusses the main idea(s).
4. The group comes to consensus about the main idea(s).
5. The group talks about how to write the main idea(s).
6. Each group member writes down the main idea(s).
    - Repeat for each paragraph of the reading (7)

Processing

- If your group finishes before others, take some time to discuss how you might use Summary Protocol in your classrooms.

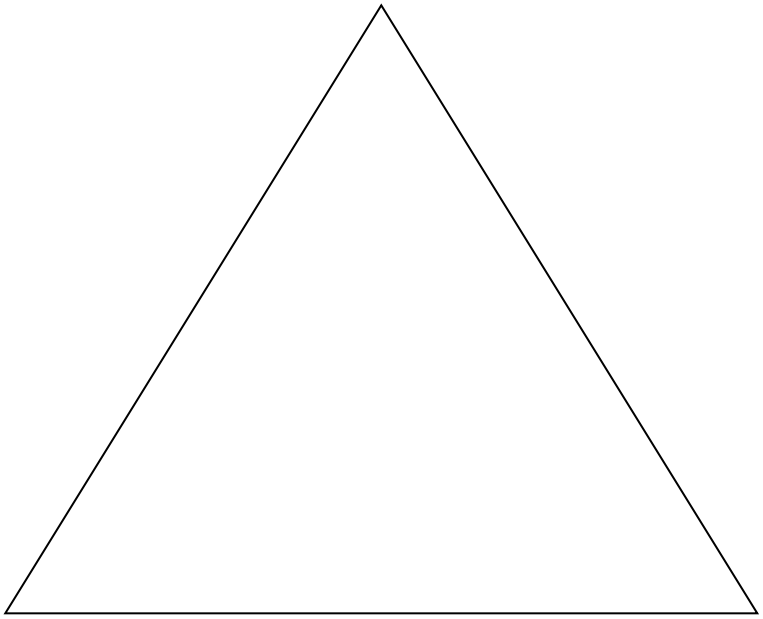
Fitness Lesson – Step 3

Applying the Fitness Concept

- You will be asked to apply what you know and have learned about fitness in a short essay.
- But, before you start writing, read the writing prompt, then turn your attention to the PPT.

The Communication Triangle

Text/Format:
essay, news
article, letter



Writer/Perspective:

Who is speaking?

Reader/Audience:

Who are you
speaking to?

Novice to Expert response

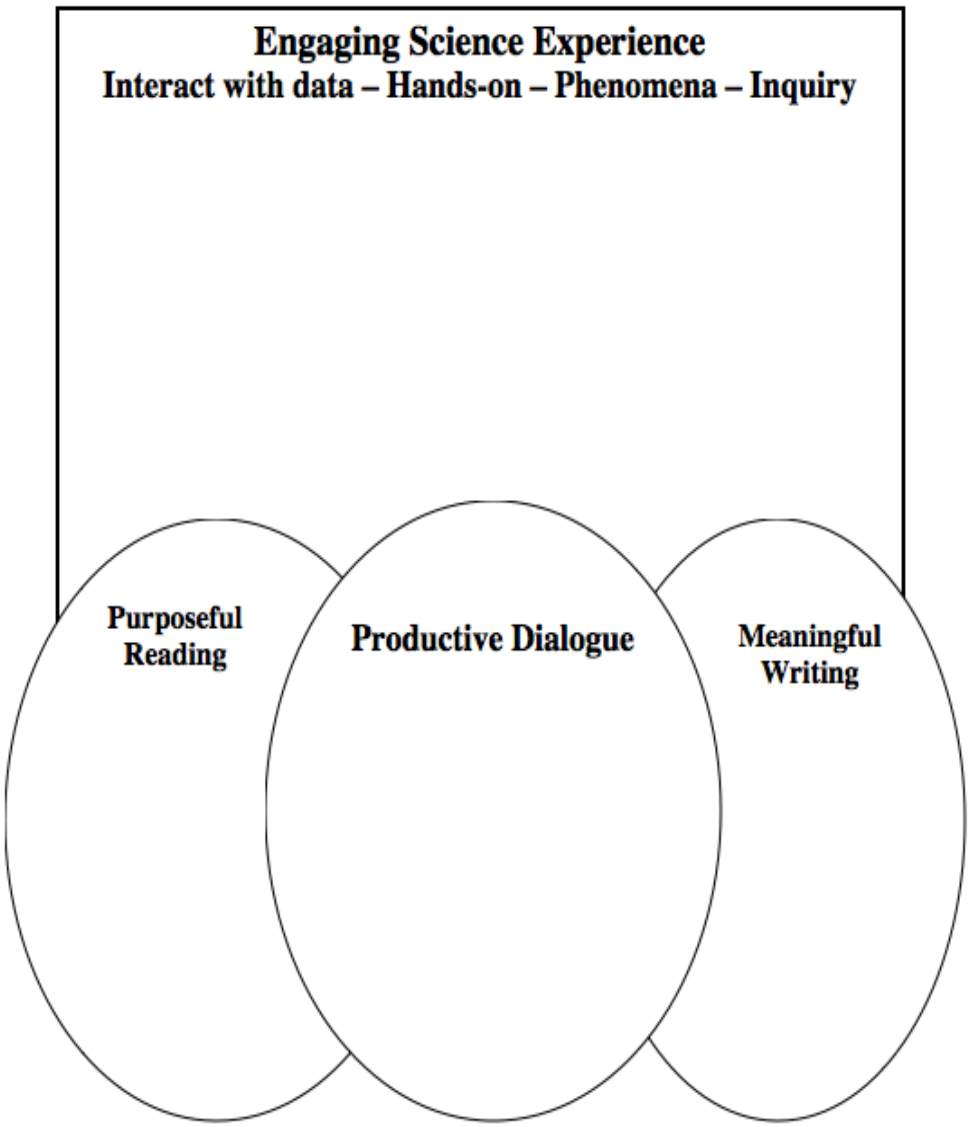
1. Don't believe that persistent analysis is essential, therefore effort and motivation to persist is weak.
2. Careless in their reasoning.
3. Don't break tasks into component parts and go step-by-step, therefore there are more errors.
4. Focus on individual details, and don't see how details relate to concepts, therefore, every concept feels new (overwhelming).
5. Formula-memorizing is a main strategy.
6. Often get behind in learning, and then sequential learning is hampered.
7. Loss of confidence in ability to achieve due to lack of success.

Fitness Lesson

Writing Prompt

- You are a wildlife biologist working in Africa. Another biologist makes the statement that "George was the largest lion, so he had the best chance of fighting off enemies. George must have the most evolutionary fitness."
- Write a letter to your colleague either agreeing or disagreeing with him. In your letter, make sure you support your position with evidence from the data, from text sources and from your own thinking.

Science Literacy Framework



What Did We Hit?

What do Common Core and the Framework ask for?

Common Core	K-12 Sci. Ed. Framework
Speaking and Listening: • Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on topics and texts, building on others' ideas and expressing their own clearly. **Reading:** • Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. **Writing:** • Write opinion pieces on topics or texts, supporting a point of view with reasons. • Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.	• Ask questions about data • Analyze and Interpret Data • Use information from texts and diagrams • Interpret information presented visually, orally, or quantitatively • Engaging in argument from evidence • Construct an argument using evidence • Obtain, Evaluate, and Communicate Information • Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas.

Applying the Communication Triangle Examples of Writing Prompts

- You are a geologist studying rocks to determine the direction of flow of an ancient glacier. What clues might help you determine the glacier's direction of flow? Put your answer in the form of a "Do-It-Yourself" guide to determining glacial flow direction.
- You are an earthquake safety expert and on a radio program. A caller asks the question, "if you are in a car out in the open during an earthquake would you be safest staying in the car?" Write what you would say to the caller.
- You are a doctor with a patient who has a condition in which some bad molecules are getting into their cells. Write an email to them that explains how a cell membrane is structured to keep some molecules out and let others in.
- Someone has written into a science magazine saying they have discovered a new element and they say it is a new transition metal. You are the science editor and are writing an editorial on the discovery. In your editorial describe the types of properties the new element should have.
- Sea World has contacted you because you are a marine biologist. They want you to write the content for a display that will explain the forces that influence whether a dolphin floats or sinks while it is at rest in the ocean.

Challenge Statements

- Challenge Statements are carefully crafted prompts that employ an appropriate amount of ambiguity.
- They are a statement, not a question.
- Challenge Statements invite responders to agree, disagree or fall somewhere in between.
- The full Challenge Statement includes the statement, the directions and a chance to revise ones thinking via dialogue with others (last part is optional).

Challenge Statement

- *Genetic variation is more important than environmental influences in natural selection.*

DIRECTIONS – Consider the statement above. You might agree, disagree, or be somewhat in between. Write a response explaining your thinking about the statement. Please limit your technical vocabulary. If you need to use scientific terms be sure to explain what you mean.

Examples of Challenge Statements

- ATP is the most important molecule for cells.
- If something grows, moves and reacts to things it must be alive.
- The most critical phase of mitosis is metaphase.
- Fossils are the main evidence for plate tectonics.
- Water is more dense than ice because water molecules are smaller than ice molecules.
- If you had a helium balloon on the moon it would not float.
- Very large stars are more red than yellow.
- Gravity works in one direction.
- Any metal will conduct electricity.
- If the water on land becomes polluted we can just use the water from the ocean as long as we take the salt out.
- Earthquakes are more dangerous than tsunamis.
- Mechanical weathering takes place before chemical weathering.
- In glaciers all the types of moraines are essentially the same.

Thank You

- http://sasp.ucdavis.edu
- acbeauchamp@ucdavis.edu

Why science teachers are not asked to monitor recess.

SUCCESS IN SCIENCE

through DIALOGUE, READING and WRITING

by ARTHUR BEAUCHAMP
JUDI KUSNICK
RICK McCALLUM

edited by JIM HOLLANDER